Received: 29 September 2017 | Revised: 18 April 2020 | Accepted: 20 April 2020

DOI: 10.1111/isj.12292

WILEY

RESEARCH ARTICLE

Understanding massively multiplayer online role-playing game addiction: A hedonic management perspective

Zach W. Y. Lee[1] | Christy M. K. Cheung[2] | Tommy K. H. Chan[3]

[1]Durham University Business School, Durham University, Durham, UK

[2]Department of Finance and Decision Sciences, Hong Kong Baptist University, Kowloon Tong, Hong Kong

[3]Newcastle Business School, Northumbria University, Newcastle upon Tyne, UK

Correspondence
Zach W. Y. Lee, Durham University Business School, Durham University, Durham, UK.
Email: zach.lee@durham.ac.uk

Funding information
National Natural Science Foundation of China, Grant/Award Number: 71828202

Abstract

Massively multiplayer online role-playing game (MMORPG) addiction presents a serious issue worldwide and has attracted increasing attention from academic and other public communities. This article addresses this critical issue and fills research gaps by proposing and testing a research model of MMORPG addiction. Building on the conceptual foundation of the hedonic management model of addiction and the technology affordance perspective, we develop a research model explaining how MMORPG affordances (ie, achievement, social and immersion affordances) are associated with the duality of hedonic effects (ie, perceived positive mood enhancement and perceived negative mood reduction) and the extent of MMORPG addiction. Using structural equation modelling, we empirically test our research model with 406 MMORPG players. The results show that both perceived positive mood enhancement and perceived negative mood reduction positively correlate with the extent of MMORPG addiction. Furthermore, achievement and immersion affordances are positively associated with the duality of hedonic effects, whereas social affordance is not. Our study contributes to the growing

body of technology addiction literature by revealing the relationships between the two hedonic effects and the extent of MMORPG addiction, and by offering a contextualised explanation of the role of MMORPG affordances in these relationships. We offer an alternative perspective on the far-reaching, unintended relationships between technological affordances and addictive technology use. Our study provides game developers and policymakers with insights into preventing MMORPG addiction to create an entertaining, healthy virtual playground.

KEYWORDS

duality of hedonic effects, hedonic management model of addiction, massively multiplayer online role-playing game, MMORPG, technology addiction, technology affordance

1 | INTRODUCTION

In response to the call for information systems (IS) research on the dark side of technology use (Tarafdar, Gupta, & Turel, 2015), research on technology addiction has grown steadily in the IS discipline. Most technology addiction studies have been conducted in the context of hedonic technologies, with social networking sites and online games being the most popular research foci (eg, Gong, Zhang, Cheung, Chen, & Lee, 2019; Hyun et al., 2015; Xu, Turel, & Yuan, 2012; Xue et al., 2018). One possible reason for the increasing scholarly attention to online gaming addiction is that more individuals are spending time on online leisure activities every day. Recent market research demonstrates the prominence of gaming in the online entertainment industry, with 86% of Internet users reporting online gaming in the previous month (GlobalWebIndex, 2018). Furthermore, there is ample evidence of the negative consequences of online gaming addiction, such as reduced decision-making ability, interpersonal problems, mental and physical health problems and even death (Lee, 2013; Thomas, 2014; Ye, 2015). Recognising the severity of the problem of online gaming addiction, the World Health Organization included gaming disorder in the eleventh revision of the International Classification of Diseases (ICD-11), and the American Psychiatric Association included Internet gaming disorder as a "condition requiring further study" in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DMS-5), signalling the potential dangers associated with online gaming.

Massively multiplayer online role-playing games (MMORPGs), which involve players customising their fictional in-game characters, interacting with other game players, and exploring never-ending immersive virtual worlds, are regarded as potentially addictive (Bacchini, De Angelis, & Fanara, 2017; Hsu, Wen, & Wu, 2009; You, Kim, & Lee, 2017). MMORPG addiction is a psychological state of maladaptive dependency on playing MMORPGs, which is "manifested through an obsessive pattern of IT-seeking and IT-use behaviours that take place at the expense of other important activities and infringe normal functioning" (Turel & Serenko, 2012

, p. 514). A multinational study finds that the rate of MMORPG addiction among sampled respondents ranges between 3.6% and 44.5%1(Hussain et al., 2012). Indeed, the MMORPG population has increased steadily, and the top five MMORPGs in 2020 together account for 14.5 million players (Babalon, 2020). Given the large population of MMORPG players worldwide, even a small MMORPG addiction rate would imply enormous challenges to individuals and society. MMORPG addiction is a serious societal issue (Hsu et al., 2009; Kim, Kim, Shim, Im, & Shon, 2013; You et al., 2017), and it deserves further attention from governments, game developers, and the scientific community.

Understanding MMORPG addiction is important to the scientific community for several reasons. First, like the online gaming addiction literature in general, most MMORPG addiction studies stem from the clinical psychology, medical and psychiatry fields. These studies primarily focus on (a) aetiology (eg, risk factors), (b) pathology (eg, assessments and prevalence) and (c) ramifications (eg, negative consequences and treatments). There is a lack of theoretical explanation for the psychological mechanisms underlying MMORPG addiction. Second, the primary reason people play MMORPGs is for entertainment (Mancini & Sibilla, 2017). Although researchers argue that players engage in online gaming to enhance positive mood and reduce negative mood (Barnett & Coulson, 2010), the two types of hedonic effects have not been systematically investigated in the context of MMORPG addiction. The positive and negative reinforcement mechanisms are relevant and appropriate to the study of MMORPG addiction. For example, MMOPRGs use reward schedules—wherein players are presented with numerous tasks and rewarded upon completion—to encourage prolonged gaming (Snodgrass, Lacy, Dengah, & Fagan, 2011b; Taylor & Taylor, 2009). Additionally, immersion in the virtual worlds of MMORPGs helps players to cope with their negative mood, which in turn encourages continuous gaming (Blasi et al., 2019). Third, researchers have repeatedly called for the inclusion of technology- or context-specific variables in IS research (Hong, Chan, Thong, Chasalow, & Dhillon, 2014). Although there is growing interest in understanding the role of IT artefacts and designs in technology addiction (eg, Nyamadi & Boateng, 2018; Yang, Liu, & Wei, 2016), the effects of contextual factors on MMORPG addiction continue to be under-investigated. Considering that MMORPG addiction is a serious societal issue and gaps remain in the literature, our primary research objective is to enrich our theoretical understanding of MMORPG addiction by examining the relationships among MMORPG-specific variables, the duality of hedonic effects, and the extent of MMORPG addiction.

To achieve our objective, we draw on the hedonic management model of addiction (Brown, 1997) to construct our model. In particular, we examine how the duality of hedonic effects (ie, perceived positive mood enhancement and perceived negative mood reduction) correlates with the extent of MMORPG addiction. We extend the hedonic management model of addiction by using the technology affordance perspective (Markus & Silver, 2008) to examine how MMORPG affordances are associated with the duality of hedonic effects in gameplay.

The article is organised as follows. In Section 2, we review the extant research on technology addiction, online gaming addiction, and MMORPG addiction. We then introduce the hedonic management model of addiction and the concept of technology affordance, which are the theoretical foundations of our study. In Section 3, we present our research model and hypotheses. We describe our methods and report our results in Sections 4 and 5. In Section 6, we discuss our findings, highlight their implications for both research and practice, and outline potential avenues for future research.

2 | LITERATURE REVIEW

2.1 | Technology addiction

We note certain research patterns in the IS literature on the increasingly important topic of technology addiction. First, studies on technology addiction are conducted in the context of utilitarian, dual-purpose and hedonic technologies with divergent foci. For instance, Turel, Serenko, and Bontis (2011) examine addiction to utilitarian technologies in the context of email, focusing on the resulting negative consequences for family (ie, technology-family conflict and work-family conflict) and work environments (ie, work overload and reduced organisational commitment). Soror, Hammer, Steelman, Davis, and Limayem (2015) investigate addiction to dual-purpose technologies in the context of mobile phones, focusing on both the antecedents and the negative consequences. Furthermore, most studies are conducted in the context of hedonic technologies and focus primarily on social networking sites (eg, James, Lowry, Wallace, & Warkentin, 2017; Turel, 2015; Turel & Serenko, 2012). MMORPGs do not receive commensurate scholarly attention in the IS literature. Second, researchers consistently highlight the role of hedonic effects, such as

enjoyment (eg, Turel & Serenko, 2012), playfulness (eg, Jia & Jia, 2008) and flow (eg, Theotokis & Doukidis, 2009) in technology addiction. These studies, however, examine such hedonic effects on the extent of technology addiction primarily from the positive reinforcement perspective. There is a lack of attention to the negative reinforcement perspective (eg, reducing negative mood or feeling states) in explaining technology addiction. The relationships between the duality of hedonic effects and technology addiction warrant further investigation. Third, in contrast to studies on positive technology uses—which are rooted in prominent theoretical frameworks such as the technology acceptance model, the IS success model, and the IS continuance model—studies of technology addiction adopt diverse theoretical frameworks and lenses, such as uses and gratifications theory (eg, Li, Guo, & Bai, 2017), cognitive-affective-behavioural model (eg, Wang, Lee, & Hua, 2015) and flow theory (eg, Zhang, Chen, Zhao, & Lee, 2014). While such theoretical diversity enhances our understanding of technology addiction from different perspectives, this study contributes to the literature by providing a systematic investigation of the duality of hedonic effects and the extent of technology addiction.

2.2 | Online gaming addiction and MMORPG addiction

Online gaming addiction is an emerging topic. Young (2009) emphasises that to understand online gaming addiction, it is crucial to know how such addiction stems from the creation of virtual worlds. Online games are video games that are played on the Internet using a variety of gaming platforms (Rollings & Adams, 2006). Online games vary in genre. There are, for example, first-person shooter games, real-time strategy games, and massively multiplayer online role-playing games. Each game genre has unique gameplay interactions (Quandt & Kröger, 2014). For instance, first-person shooter games centre around weapon-based combat from a first-person perspective, whereas role-playing games emphasise role-playing characters in a fictional virtual world. Although online gaming addiction is the subject of increasing scholarly attention, prior studies primarily focus on generic antecedents, such as personality traits and psychopathological conditions (eg, Hyun et al., 2015; Lee, Ko, & Lee, 2019; Mehroof & Griffiths, 2010), and tend to overlook the effects of game-specific variables.

This study focuses specifically on MMORPG addiction. We conduct a literature review to understand the research state of MMORPG addiction, and review studies that focus on MMORPGs in particular and those that examine online gaming addiction in the context of MMORPGs. Our literature review reveals several research patterns that motivate our investigation (see Appendix A of Data S1 for a summary of the studies). Most extant studies focus on examining antecedents or risk factors correlated with addiction. Personality traits are among the most studied antecedents to online gaming and MMORPG addiction (eg, Charlton & Danforth, 2010; Hu, Zhen, Yu, Zhang, & Zhang, 2017; Mehroof & Griffiths, 2010), followed by psychopathological conditions, such as anxiety, loneliness and depression (eg, Hyun et al., 2015; Lee et al., 2019; Mehroof & Griffiths, 2010), and demographic variables, such as age, gender, gaming time and players' experience (eg, Hussain et al., 2012; Hussain & Griffiths, 2009b; Hyun et al., 2015). As most studies stem from the clinical psychology, medical and psychiatry fields, they tend to focus on diagnostic aspects and investigate the direct relationships between antecedents/risk factors and addiction.

The generic factors that predispose players to addiction—such as personality traits, psychopathological conditions and demographic variables—are extensively researched and can be applied to different online game genres, including MMORPGs. However, the effects of MMORPG-specific variables on addiction do not receive commensurate scholarly attention, rendering it difficult to derive contextualised insights into this phenomenon. Nevertheless, MMORPGs are regarded as potentially addictive because of their interactive and immersive structural characteristics (Bacchini et al., 2017; Hsu et al., 2009; You et al., 2017). MMORPGs afford players the possibility to adopt and customise a character in the virtual world with an evolving storyline over time, to socialise and interact collaboratively and competitively with thousands of other players simultaneously, and to immerse themselves in a fantasy world to escape from everyday life. Indeed, IS research consistently calls for the inclusion of technology- or context-specific

variables (Hong et al., 2014) and a better understanding of specific IT artefacts and designs in technology addictions (Turel, Serenko, & Giles, 2011).

2.3 | The hedonic management model of addiction

The hedonic management model of addiction suggests that performing certain activities for a good hedonic tone (ie, states of relative pleasure and euphoria) is highly related to various forms of behavioural addiction (Brown, 1997; Hussain et al., 2012). Goodman (1990) contends that addictive behaviour functions not only to induce pleasure but also to alleviate internal discomfort. Specifically, enhancing positive mood or relieving negative mood influences behavioural addictions through positive reinforcement and negative reinforcement mechanisms, respectively. The positive reinforcement perspective posits that individuals might become addicted to a certain behaviour if they enjoy the positive aspects of such behaviour. The negative reinforcement perspective suggests that individuals might become addicted to a certain behaviour if such behaviour helps them to cope with negative mood (Chen et al., 2017; Elhai, Dvorak, Levine, & Hall, 2017; Robinson & Berridge, 2003; Wegmann, Stodt, & Brand, 2015). These pathways are not mutually exclusive, and researchers already incorporate both into their investigations of behavioural addictions. For example, researchers find that gambling addiction is associated with both positive (eg, gambling for excitement) and negative reinforcements (eg, gambling for relief of anxiety) (Robbins & Clark, 2015). Elhai et al. (2017) find that smartphone addiction involves two mechanisms—the craving for positive mood and the desire to alleviate negative mood.

The hedonic management model of addiction is used to explain a wide spectrum of behavioural addictions intimately involved with hedonic management, such as gambling addiction (Brown, 1993), crime addiction (Brown, 1997), exercise addiction (Kerr, Lindner, & Blaydon, 2008), computer addiction (Charlton, 2002), Internet addiction (Quinones & Kakabadse, 2015) and online gaming addiction (Clark, 2006; Hussain & Griffiths, 2014). MMORPG addiction is a type of behavioural addiction. Prior studies suggest that the hedonic management model of addiction is useful for explaining the mechanisms underlying MMORPG addiction, given MMORPGs' hedonically rewarding nature (Charlton & Danforth, 2007; Hussain et al., 2012). Although prior research demonstrates the model's applicability in behavioural addiction research, we further this work through attention to MMORPG-specific variables.

2.4 | The technology affordance perspective

The concept of affordance—referring to the uses of an object as perceived by the user—was first introduced to IS research by Norman (1998). It has since gained momentum in the IS literature and is increasingly used to explain different phenomena involving technology use, such as online knowledge sharing (Majchrzak, Faraj, Kane, & Azad, 2013), cyberbullying (Chan, Cheung, & Wong, 2019), IT-related organisational changes (Leonardi, 2013; Volkoff & Strong, 2013), and gamification in the workplace (Suh, Cheung, Ahuja, & Wagner, 2017). Technology affordance refers to "the possibilities for goal-oriented action afforded to specified user groups by technical objects" (Markus & Silver, 2008, p. 622). The technology affordance perspective prompts researchers to consider the mutuality between the action to be taken and the capability of the technology.

Prior studies in the IS literature demonstrate the applicability and merits of integrating the technology affordance perspective into theoretical frameworks, as the integration enables researchers to derive contextualised insights into the phenomena of interests (eg, Chatterjee, Moody, Lowry, Chakraborty, & Hardin, 2015; Leonardi, 2013; Suh et al., 2017). For instance, Chatterjee et al. (2015) integrate the technology affordance perspective with the notion of virtue ethics to explain how organisational technology affordances, such as collaboration, organisational memory, and process management affordances influence organisational virtues. Similarly, Suh

et al. (2017) integrate the technology affordance perspective with the theory of aesthetic experience to explain how gamification affordances affect user engagement with IS in the workplace. The results show that the three gamification affordances—status, competition, and self-expressionaffordances—positively correlate with flow experience and aesthetic experience, which in turn influence continuance intention to use IS in the workplace. Accordingly, we expect the technology affordance perspective to offer a useful theoretical lens for us to derive a contextualised understanding of MMORPG addiction.

3 | RESEARCH MODEL AND HYPOTHESIS DEVELOPMENT

Drawing on the hedonic management model of addiction, we explain how the duality of hedonic effects correlates with the extent of MMORPG addiction. We extend the hedonic management model of addiction by incorporating the technology affordance perspective, and explain the relationships between the three MMORPG-specific affordances and the duality of hedonic effects. Figure 1 depicts our research model.

3.1 | MMORPG addiction and hedonic management

Adapting the definition of technology addiction (see Turel & Serenko, 2012; Turel, Serenko, & Giles, 2011), we define MMORPG addiction as a psychological state of maladaptive dependency on playing MMORPGs to such a degree that typical behavioural addiction symptoms arise. In the hedonic management model of addiction, when an individual discovers a reliable, continuous source (eg, playing MMORPGs) through which to obtain a good hedonic tone, the individual is likely to prioritise the activity. In turn, this prioritisation might dominate his or her thinking and behaviour, setting the stage for addiction. In particular, our model identifies two pathways for hedonic management—namely enhancing positive mood and relieving negative mood (Brown, 1993; Charlton & Danforth, 2007). Playing MMORPGs is a reliable activity and hedonic source that enhances players' positive mood

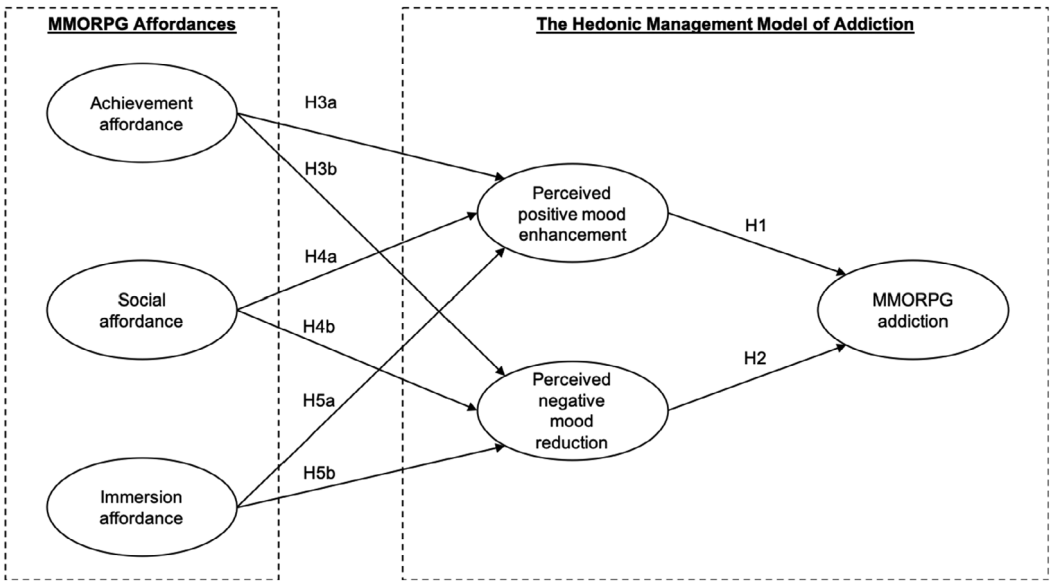

FIGURE 1 Research model. Perceived positive mood enhancement and perceived negative mood reduction refer to a user's perception of the system's ability to change his/her mood, not to whether a person's mood changes

and relieve their negative mood (Barnett & Coulson, 2010), which puts players at risk of addiction. Previous studies indicate that players who thrive on or unwind by playing MMORPGs might be engrossed in such gaming and thus continue playing (Barnett & Coulson, 2010). When the use of such technology acts as an important mechanism for modifying one's mood, addiction becomes likely (Caplan, 2010).

3.1.1 | Perceived positive mood enhancement

Perceived positive mood enhancement refers to users' perception that playing MMORPGs can enhance their positive mood. The relationship between perceived positive mood enhancement and the extent of MMORPG addiction might be explained through the positive reinforcement mechanism. Reinforcement refers to the strengthening of one's future behaviour (ie, increasing the frequency and duration of that behaviour) whenever that behaviour is preceded by specific antecedent stimuli (Flora, 2012). A behaviour (eg, playing MMORPGs) is positively reinforced when a desirable event (eg, enhancing one's positive mood) is presented as an outcome of that behaviour (Flora, 2012). The positive reinforcement perspective is regarded as a crucial mechanism that explains behavioural addictions associated with hedonically rewarding activities (Robinson & Berridge, 2003), such as cybersex addiction (eg, Laier, Pawlikowski, Pekal, Schulte, & Brand, 2013; Young, 2008) and social networking site addiction (eg, Turel & Serenko, 2012). In the context of MMORPGs, players are found to experience an increase in positive mood after playing and thus continue playing (Barnett & Coulson, 2010). The positive mood enhancement through various game experiences, such as reward schedules that reward players when they accomplish in-game tasks (Snodgrass et al., 2011b; Taylor & Taylor, 2009), encourages players to continue playing the games. Following the notion of positive reinforcement, we expect that when players perceive that playing MMORPGs can enhance their positive mood, they are likely to increase the frequency and duration of their gameplay, which might thus displace other daily activities and increase the extent of MMORPG addiction. Therefore, we hypothesise that:

H1 The higher the extent of the perceived positive mood enhancement, the higher the extent of MMORPG addiction will be.

3.1.2 | Perceived negative mood reduction

Perceived negative mood reduction refers to users' perception that playing MMORPGs can alleviate their negative mood. The relationship between perceived negative mood reduction and the extent of MMORPG addiction might be explained through the negative reinforcement mechanism. Negative reinforcement occurs when the frequency and duration of a behaviour (eg, playing MMORPGs) increase following the removal of an undesirable event or stimulus (eg, relieving one's pain or negative mood) (Flora, 2012). The negative reinforcement perspective suggests that relieving unpleasant feelings is a negative reinforcer-associated with an increase in the frequency and duration of a particular behaviour, which thus increases the likelihood of addiction (Dong & Potenza, 2014). Perceived negative mood reduction is found to be an important antecedent to behavioural addictions (Berczik et al., 2014). For instance, exercising as a means of relieving negative feelings and escaping from everyday difficulties is associated with exercise addiction (Berczik et al., 2014). Prior studies contend that addictions to hedonic technologies might be explained through negative reinforcement (eg, Muñoz-Rivas, Fernández, & Gámez-Guadix, 2010). In particular, playing online games can help individuals avoid everyday hassles and distress, which thus reinforces gaming behaviour and predisposes players to addiction (Bargeron & Hormes, 2017; Hagström & Kaldo, 2014). In the context of MMORPGs, the games allow players to unwind themselves from negative mood, which makes them continue playing (Barnett & Coulson, 2010). For instance, MMORPG players believe that immersing themselves into the virtual world can help them to cope with their negative mood linked to external stressors, and thus they continue to play (Blasi

et al., 2019). Following the notion of negative reinforcement, when players perceive that MMORPGs can reduce their negative mood, they are likely to increase the frequency and duration of their gameplay, which might thus displace other daily activities and increase the extent of MMORPG addiction. Therefore, we hypothesise that:

H2 The higher the extent of the perceived negative mood reduction, the higher the extent of MMORPG addiction will be.

3.2 | Hedonic management and MMORPG affordances

We extend the hedonic management model of addiction by incorporating the technology affordance perspective. Affordances are defined as "the possibilities for goal-oriented action afforded to specified user groups by technical objects" (Markus & Silver, 2008, p. 622). The affordance concept was first introduced to IS research by Norman (1998), and it has since gained momentum in the IS literature. Affordances serve as a link that unites users with technical objects (Grgecic, Holten, & Rosenkranz, 2015; Markus & Silver, 2008). Markus and Silver (2008) align technical objects with IT artefacts and their component parts, and define functional affordances as the possibilities for goal-oriented action that technical objects offer specific user groups. In this study, the technical objects are MMORPGs and their associated structural characteristics, and the functional affordances are three MMORPG-specificaffordances—namely achievement affordance, social affordance and immersion affordance. Technical objects indirectly influence behaviours involving technology use through salient beliefs (Al-Natour & Benbasat, 2009). Grgecic et al. (2015) suggest that functional affordances shape users' beliefs about such objects. Specifically, functional affordances, which hinge on the relationship between the technical objects' material properties and the users' abilities to grasp them, can be perceived differently and might influence the beliefs associated with such technical objects (Grgecic et al., 2015; Robey, Anderson, & Raymond, 2013). Thus, although players play MMORPGs primarily for hedonic purposes, MMORPG-specific affordances might correlate with varying beliefs about the MMORPGs' abilities to enhance positive mood or reduce negative mood depending on the players' goals, perceptions, or personal characteristics.

3.2.1 | Achievement affordance

Achievement affordance refers to the extent to which MMORPGs offer players the potential or possibility of attaining achievement through playing the game. MMORPGs enable players to obtain in-game achievements. Players can level up their characters, accumulate resources, analyze and understand the game's mechanics and/or compete with players (Yee, 2006a). For instance, the popular MMORPG World of Warcraft (WoW) has ample structural properties that afford achievement potential. In WoW, the character levelling system affords players the possibility of levelling up their in-game characters; the talent point system affords players the possibility of earning skill points when their characters level up; and the battleground affords players the possibility of completing mission objectives to achieve victory. The effects of in-game achievement can be explained through the game reward systems, which provide players with satisfying gaming experiences and pleasure (Wang & Sun, 2011). Specifically, being successful or accomplishing in-game missions can strengthen a player's self-worth and confirm that he or she is competent enough to complete a mission or to battle opponents, both of which are hedonically rewarding (Rieger, Wulf, Kneer, Frischlich, & Bente, 2014; Trepte & Reinecke, 2011).

Prior studies find that in-game achievement can enhance players' positive mood and reduce their negative mood. For instance, Meghdad (2016) finds that players feel excited and satisfied about levelling up in-game characters. Kirby, Jones, and Copello (2014) suggest that in-game achievements are positively associated with players' mood. Hussain and Griffiths (2009a) find that some players treat in-gameachievements—such as killing monsters to

alleviate frustration or stepping out of everyday stress by taking control of their virtual lives—as a form of relief. From the affordance perspective, although MMORPGs offer players the possibility of attaining different achievements, the perceived mood-modifying ability (eg, enhancing positive mood or relieving negative mood) varies according to the players' goals. Therefore, we propose that achievement affordance is positively related to players' perceptions of positive mood enhancement and negative mood reduction. We hypothesise as follows:

H3a The higher the extent of the achievement affordance, the higher the extent of perceived positive mood enhancement will be.

H3b The higher the extent of the achievement affordance, the higher the extent of perceived negative mood reduction will be.

3.2.2 | Social affordance

Social affordance refers to the extent to which MMORPGs offer players the possibility of socially interacting with others through playing the games. MMORPGs enable players to socially interact with others in various ways, such as casual chatting, building relationships, lending support and collaborating with others (Crenshaw & Nardi,). For instance, WoW has ample structural properties that afford the possibility of socialising. The chat channel gives players the chance to talk to other players either through text or voice chat; the referral scheme affords players the possibility of bringing their real-life relationships into WoW and receiving exclusive in-game benefits when they play together; and the dungeon affords players the possibility of forming small groups and working as a team. In a team context, players are allowed to specify their roles as tanks, damage dealers, or healers. Social interaction is one of the most effective mechanisms to regulate mood (Thayer, Newman, & McClain, 1994), and in-game socialisation and interaction are hedonically rewarding to players (Wang & Sun, 2011). Social interaction and support can encourage individuals and improve their self-esteem and well-being(Manne & Zautra, 1989), and can also serve as a buffer that allows individuals to unwind from negative mood caused by potentially noxious events (Cohen & Wills, 1985). In particular, a strong social support system (such as those afforded by MMORPGs) can help individuals to pay more attention to the positive aspects of noxious situations such that they perceive these situations as less threatening.

Socialisation is found to enhance players' positive mood and reduce negative mood. Sanders, Dowland, and Furnell (2011) find that players feel pleasure when they socialise with others in MMORPGs, and 96% of the respondents in their study report that they discuss personal issues with their fellow players during game playing. Cole and Griffiths (2007) contend that social interaction represents an element that is crucial to enjoyable gaming. Some players report that they play MMORPGs to reduce loneliness and negative feelings by interacting with friends or making new friends in the game (Hussain & Griffiths, 2009a). From the affordance perspective, although MMORPGs offer players the possibility of socialising and interacting in-game, the perceived mood-modifying ability (eg, to enhance positive mood or relieve negative mood) varies depending on the players' goals. Therefore, we propose that social affordance is positively related to players' perception that playing MMORPGs enhances positive mood and reduces negative mood. As such, we propose the following hypotheses:

H4a The higher the extent of the social affordance, the higher the extent of the perceived positive mood enhancement will be.

H4b The higher the extent of the social affordance, the higher the extent of the perceived negative mood reduction will be.

3.2.3 | Immersion affordance

Immersion affordance refers to the extent to which MMORPGs offer players the potential or possibility of understanding, exploring and discovering the virtual game world and immersing themselves in it (Meghdad, 2016). MMORPGs enable players to understand and explore the virtual game world through various means. Players can customise characters, create storylines for characters, and explore and discover hidden things that allow them to more fully immerse themselves in the virtual game world (Crenshaw & Nardi,). For instance, WoW has ample structural properties that afford the potential of immersing oneself in the virtual world. The map navigation function affords players the possibility of retrieving details about places (such as buildings, cave entrances and shops) and discovering new territories; the role-playing system affords players the possibility of defining the roles of their characters (eg, choosing to become a mage who is a powerful spell caster); and the customisation system affords players the possibility of creating and customising their characters in terms of gender, race, profession and appearance. The immersive characteristics are hedonically rewarding for players because they allow players to more fully identify with the virtual worlds and become so immersed in the richness of the game world that they can "lose themselves" (Snodgrass, Dengah II, Lacy, & Fagan, 2013). These absorptive and dissociative experiences can contribute to pleasure (Snodgrass, Lacy, Dengah, & Fagan, 2011a). However, immersion in a virtual game world blurs the boundaries between actual and virtual worlds and allows players to escape from their real-life problems and negative mood (Billieux et al., 2011).

Immersion in a virtual game world is found to enhance players' positive mood and reduce their negative mood. For instance, some players find immersing themselves in the virtual game world of MMORPGs to be entertaining and rewarding (Lukavska, 2012). Beyond this, however, players often play MMORPGs as a way of escaping from everyday hassles and distress (Hagström & Kaldo, 2014). From the affordance perspective, although MMORPGs offer players the potential for and possibility of various forms of in-game immersion, the perceived mood-modifying ability of gaming (eg, enhancing positive mood or relieving negative mood) varies depending on the players' goals. Therefore, we propose that immersion affordance is positively related to players' perception that the MMORPGs can enhance positive mood and reduce negative mood. We hypothesise as follows:

H5a The higher the extent of the immersion affordance, the higher the extent of the perceived positive mood enhancement will be.

H5b The higher the extent of the immersion affordance, the higher the extent of perceived negative mood reduction will be.

4 | RESEARCH METHOD

4.1 | Research design and data collection

To test our research model, we recruited MMORPG players who had played WoW 4 weeks prior to the time of data collection to participate in an online survey. The online survey is the most commonly used data collection method in studies of technology addiction (Byun, Niang, & Lee, 2009). With over 7 million active players, WoW is one of the most popular MMORPGs in the world (Gilbert, 2015). Through a market research firm, we invited members of a nationwide (United States) panel of online game players to participate in the survey. The following two screening questions were asked at the beginning of the survey to identify respondents: (a) "Which online game genre(s) do you usually play?" and (b) "Which MMORPG(s) do you usually play?" Screening Question 1 offered multiple choices of different online game genres, such as action game, adventure game and MMORPG. Screening Question 2 offered multiple choices of different MMORPGs, such as Guild Wars 2, Rift and WoW. The respondents were allowed to

choose a maximum of three choices for each screening question. Only those who selected "MMORPG" in Screening Question 1 and "WoW" in Screening Question 2 were allowed to complete the remaining parts of the questionnaire. The other participants were thanked and dismissed.

To ensure data quality in our study, we followed the guidelines advocated in the methodological literature (Steelman, Hammer, & Limayem, 2014). We included human verification features in Qualtrics to flag responses that could have been completed by bots and duplicated. To track which responses were likely from bots, we enabled in our survey setting the "Bot Detection" feature, which uses invisible reCaptcha technology to flag a response as a bot if the score is below 0.5. To detect duplicates, we enabled the "Prevent Ballot Box Stuffing" feature, which flags a response as a duplicate if respondents attempt to complete the survey under the same cookie. We excluded responses that were completed in less than 5 minutes, and presented five attention check questions randomly throughout the questionnaire to identify any possible careless, random, or haphazard responses. The five attention check questions required respondents to select a particular option for certain questions. The five questions were 'Please select "strongly disagree" for this statement'; 'If adding two to the number three equals five, then only select "somewhat agree" and nothing else'; 'If adding two to the number six equals eight, then only select "neutral" and nothing else'; 'If you have been answering honestly thus far, please only select "agree" and nothing else'; and 'Please select "strongly agree" for this statement.'

We collected 466 responses and removed 60 responses that were incomplete, flagged as bots and duplicates, or that failed any attention check question, thus yielding a sample of 406 respondents for our subsequent statistical analyses. Of these respondents, 59.4% were male, 40.6% were female and 60.6% were aged 21 to 30. Regarding MMORPG usage, 69% of the respondents played for 1 hour or more daily, and 54.7% of the respondents played at least 5 days a week. Table 1 summarises the descriptive statistics of the sample.

4.2 | Measures

We adopted the measurement items of three scales2 for MMORPG addiction from Turel, Serenko, and Giles (2011) and Serenko and Turel (2015). Given the diversity of measurement scales for technology addiction constructs (Byun et al., 2009), there are three approaches for measuring technology addiction. Following Turel, Serenko, and Giles (2011), we measured the extent of MMORPG addiction with the Compulsive Consumption Scale (CCS), the Behavioural Technology Addiction Scale (BTAS) and the Obsessive-Compulsive Scale (OCS). We adapted the measurement items from Lee, Cheung, and Chan (2015) for perceived positive mood enhancement and perceived negative mood reduction. We modified all of these measurement items to fit the MMORPG research context, and modelled them all as reflective constructs. We developed the measurement items for achievement affordance, social affordance and immersion affordance, and modelled them all as formative constructs. We developed the measurement items for achievement affordance, social affordance, and immersion affordance based on Yee's MMORPG motivations scale. Yee's scale takes into consideration both the theoretical underpinning of different gamer types (which represent a wide spectrum of players' goals in playing online games) and the empirical findings from surveying a large group of MMORPG players. Adapting Yee's scale to develop the affordance items is advantageous because it offers a comprehensive picture of what a MMORPG means to a player and how it affords different action possibilities towards fulfilling their goals. Consistent with Yee's operationalization, we modelled the MMORPG affordances as formative constructs because the affordance construct is a combination of the measurement items. The items represent the cause of the construct and are not interchangeable/replaceable. We present the instrument development of MMORPG affordances in Appendix B of Data S1 and summarise the measurement items in Table 2.

We conducted a face validity check to eliminate any potentially problematic items, such as double-barreled, ambiguous and unfamiliar items, and those with complicated syntax (MacKenzie, Podsakoff, & Podsakoff, 2011). As in Hoehle and Venkatesh (2015), our face validity check focused on the items themselves and did not require the participants to rank and respond to the items. Two IS researchers and three PhD students who were familiar with online game

TABLE 1 The demographic profile of the respondents

Demographic characteristics	Number of respondents	Percentage (%)
Gender		
Male	241	59.4
Female	165	40.6
Age		
18-20	10	2.5
21-30	246	60.6
31-40	123	30.3
41-50	21	5.2
51-60	6	1.5
61 or above	0	0
Education		
Less than high school	3	0.7
High school	67	16.5
College degree	66	16.3
Bachelor's degree	150	36.9
Master's degree	89	21.9
Doctoral degree	12	3.2
Professional degree	18	4.4
Annual income (USD)		
Less than $20 000	65	16.0
$20 000-$29 999	40	9.9
$30 000-$39 999	34	8.4
$40 000-$49 999	75	18.5
$50 000-$59 999	84	20.7
$60 000-$69 999	21	5.2
$70 000-$79 999	23	5.7
$80 000-$89 999	24	5.9
$90 000 or above	40	9.9
MMORPG usage (hour per day)		
Less than 1 h	126	31.0
1 h	88	21.7
2 h	77	19.0
3 h	25	6.2
4 h	29	7.1
5 h	16	3.9
6 h	5	1.2
Equal to or more than 7 h	40	9.9
MMORPG usage (day per week)		
1 d	17	4.2
2 d	39	9.6
3 d	60	14.8

TABLE 1 (Continued)

Demographic characteristics	Number of respondents	Percentage (%)
4 d	68	16.7
5 d	94	23.2
6 d	54	13.3
7 d	74	18.2
MMORPG experience		
1 y or less	88	21.6
2 y	99	24.3
3 y	48	11.8
4 y	64	15.7
5 y	33	8.1
6 y	9	2.2
7 y or more	65	15.9

Abbreviation: MMORPG, massively multiplayer online role-playing game.

research participated in the face validity check. They were provided with the list of measurement items and were asked to evaluate and comment on the items in regard to their simplicity, preciseness and clarity. The checked measurement items were pretested for comprehensiveness, clarity and desirable psychometric properties. Other than minor modifications in formatting, no significant problems surfaced during the face validity check and pretest.

We used the perceptual scales with the responses measured on a 7-point Likert scale for the constructs in our research model. We used multiple items to assess each construct to ensure construct validity and reliability. As demographic variables are important factors in determining IS use (Venkatesh, Morris, Davis, & Davis, 2003), we included age, gender, income, MMORPG experience, and MMORPG usage as the control variables in the research model. We also controlled for perceived enjoyment, which is shown to influence technology addiction in prior studies (Turel & Serenko, 2012).

5 | DATA ANALYSIS AND RESULTS

5.1 | Preliminary analyses

We assessed the influence of social desirability bias (SDB) by examining the Spearman correlations between MMORPG addiction constructs and the SDB scale (Turel, Serenko, & Giles, 2011). A negative correlation indicates a threat of SDB, and an absence of correlation suggests that SDB has no effect on the constructs. The Spearman correlations between the SDB scale and the three MMORPG addiction scales were respectively $rho_{ADDCCS\text{-}SDB} = -0.16$, $P < .01$, $rho_{ADDBTAS\text{-}SDB} = -0.14$, $P < .01$, and $rho_{ADDOCS\text{-}SDB} = -0.13$, $P < .01$. These correlations were smaller than the correlations between the SDB scale and the compulsive buying scale as reported by Ridgway, Kukar-Kinney, and Monroe (2008) (*rho* = −0.21, $P < .01$), and comparable to those between the SDB scale and the technology addiction scales, as reported by Turel, Serenko, and Giles (2011). Although SDB existed in this study, it was minor and did not constitute an issue.

In addition, we conducted three analyses to assess the potential threat of common method bias. First, we conducted Harman's single-factor test using principal component analysis. The first factor accounted for only 35.02% of the variance. In other words, the items in the dataset loaded significantly onto more than one principal component, indicating no single dominant factor (Harman, 1976). Second, we assessed the correlations between the principal constructs and the marker variable *organisational commitment*—a theoretically unrelated construct (Lindell & Whitney, 2001).

TABLE 2 Measures

Code	Item
Achievement affordance	
ACH1	WoW offers me the possibility to become powerful in the game
ACH2	WoW offers me the possibility to acquire rare items in the game
ACH3	WoW offers me the possibility to optimise my character as much as possible in the game
ACH4	WoW offers me the possibility to compete with other players in the game
Social affordance	
SOC1	WoW offers me the possibility to communicate with other players in the game
SOC2	WoW offers me the possibility to become part of a guild in the game
SOC3	WoW offers me the possibility to team up with other players in the game
SOC4	WoW offers me the possibility to keep in touch with other players in the game
Immersion affordance	
IMM1	WoW offers me the possibility to learn about and create stories in the game
IMM2	WoW offers me the possibility to immerse myself in the game
IMM3	WoW offers me the possibility to explore the world in the game
IMM4	WoW offers me the possibility to create the appearance and background of my character in the game
Perceived positive mood enhancement	
PME1	Playing WoW enhances my euphoric feelings
PME2	Playing WoW makes me happier
PME3	Playing WoW boosts my good feelings
Perceived negative mood reduction	
NMR1	Playing WoW relieves my dysphoric feelings
NMR2	Playing WoW releases my stress
NMR3	Playing WoW eliminates my bad feelings
MMORPG addiction (CCS)	
ADDCCS1	If I have a few minutes between engagements (eg, between classes), I just have to spend them playing WoW
ADDCCS2	I feel others would be horrified if they know of the time I spend playing WoW
ADDCCS3	I play WoW even though I have to do other things
ADDCCS4	I play WoW when I know I do not have enough time for other important things
ADDCCS5	I play WoW in order to make myself feel better
ADDCCS6	I feel anxious or nervous on days I do not play WoW
ADDCCS7	I spend minimal time on important tasks as a result of playing WoW
MMORPG addiction (BTAS)	
ADDBTAS1	I sometimes neglect important things because of my interest in WoW
ADDBTAS2	My social life has sometimes suffered because of me playing WoW
ADDBTAS3	Playing WoW sometimes interfered with other activities
ADDBTAS4	When I am not playing WoW I often feel agitated
ADDBTAS5	I have made unsuccessful attempts to reduce the time I play WoW
ADDBTAS6	I am sometimes late for engagements because of playing WoW
ADDBTAS7	Arguments have sometimes arisen because of the time I spend on playing WoW
ADDBTAS8	I think that I am addicted to WoW

TABLE 2 (Continued)

Code	Item
ADDBTAS9	I often fail to get enough rest because I play WoW
MMORPG addiction (OCS)	
ADDOCS1	Much of my time is occupied by thoughts about WoW
ADDOCS2	My thoughts about WoW interfere with my social, school, work and/or role functioning
ADDOCS3	My thoughts about WoW cause me anxiety and/or distress
ADDOCS4	I often try to turn my attention away from thoughts about WoW
ADDOCS5	I do not have much control over my thoughts about WoW
ADDOCS6	I spend much of my time thinking about WoW
ADDOCS7	Thinking about WoW interferes with my social, school, work and/or role functioning
ADDOCS8	I become anxious and/or distressed when I am prevented from thinking of WoW
ADDOCS9	I often try to resist my compulsion to think about WoW
ADDOCS10	I do not have much control over my attention on WoW
ADDOCS11	Much of my time is occupied by playing WoW
ADDOCS12	My thoughts about playing WoW interfere with my social, school, work and/or role functioning
ADDOCS13	Playing WoW cause me anxiety and/or distress
ADDOCS14	I often try to turn my attention away from playing WoW
ADDOCS15	I do not have much control over playing WoW
ADDOCS16	I spend much of my time playing WoW
ADDOCS17	Playing WoW interferes with my social, school, work and/or role functioning
ADDOCS18	I become anxious and/or distressed when I am prevented from playing WoW
ADDOCS19	I often try to resist my compulsion to play WoW
ADDOCS20	I do not have much control over my usage of WoW

Note: All items were measured using a 7-point Likert scale ranging from "1 = Strongly Disagree" to "7 = Strongly Agree". Achievement affordance, social affordance and immersion affordance are formative constructs; perceived positive mood enhancement, perceived negative mood reduction and MMORPG addictions are reflective constructs; MMORPG addictions are measured as continuous variables.

Abbreviations: BTAS, Behavioural Technology Addiction Scale; CCS, Compulsive Consumption Scale; MMORPG, massively multiplayer online role-playing game; OCS, Obsessive–Compulsive Scale; WoW, World of Warcraft.

Common method bias exists when all (or most) constructs are highly correlated, including the marker variable, in the correlation matrix. The correlations of the marker variable were trivial or low, ranging between −0.025 to 0.185, suggesting that common method bias did not likely pose a threat to this study. Third, as suggested by Pavlou, Liang, and Xue (2007), we examined the correlation matrix. Extremely high correlations (eg, $r > 0.9$) typically indicate the threat of common method bias. However, there were no extremely high correlations in the correlation matrixes (see Table 4), and the presence of low correlations (eg, $r = 0.02$) indicated that no single-factor influenced all of the constructs.

5.2 | Model testing

We validated the measurement and structural models using partial least squares (PLS) analysis, with SmartPLS 3. PLS is a component-based approach used to produce estimates with minimal restrictions on data distribution. According to Hair, Hult, Ringle, and Sarstedt (2017), compared to CB-SEM, PLS-SEM has its own merits and capacity to handle the following data and model characteristics. In terms of the data characteristics, PLS-SEM has no distributional

assumption because it is a non-parametric method. In terms of the model characteristics, PLS-SEM can easily incorporate reflective and formative measurement constructs. The methodological literature further highlights that when prior knowledge of the structural model relationships is scarce or when the emphasis of the study is exploratory, PLS-SEM is superior to CB-SEM. Furthermore, the dependent variables in our study (ie, MMORPG addictions) were non-normally distributed (ie, MMORPG Addiction(CCS)$_{\text{Kolmogorov-Smirnov test, D = 0.055, } P < .01}$; MMORPG-Addiction(BTAS)$_{\text{Kolmogorov-Smirnov test, D = 0.068, } P < .001}$; MMORPG Addiction(OCS)$_{\text{Kolmogorov-Smirnov test, D = 0.060, } P < .01}$) and our research model included formatively measured constructs (ie, achievement affordance, social affordance and immersion affordance). Based on the above methodological guidelines and reasons, we used the PLS-SEM approach to test the research model.

Following the two-step analytical approach, we performed a psychometric assessment of the measurement model, followed by an evaluation of the structural model. This approach ensured that the conclusions of the structural model were drawn from a set of measures with desirable psychometric properties (Hair et al., 2017).

5.2.1 | Measurement model

Testing the measurement model involves estimations of the internal consistency, convergent validity, and discriminant validity of the measurement items. Assessments of the reliability and validity of the formative and reflective items follow different guidelines (Hair et al., 2017). Specifically, assessing the measurement model of reflective constructs includes evaluations of reliability, convergent validity, and discrimination validity, whereas assessing the measurement model of the formative constructs includes evaluations of convergent validity, the multicollinearity among indicators, and the significance and relevance of outer weights (Hair et al., 2017). The measurement model results are summarised below. Overall, the formative and reflective measures were all reliable and valid.

Assessment of reflective constructs

Reliability refers to the internal consistency of the measurement items, and it is assessed using (a) Cronbach's alpha and (b) composite reliability (CR). As shown in Table 3, the Cronbach's alpha and CR for all of the reflective constructs were above 0.7, meeting the recommended threshold (Hair et al., 2017). Convergent validity is the extent to which the items on a scale are theoretically related (Fornell & Larcker, 1981). Convergent validity is assessed using two criteria: (a) the average variance extracted (AVE) should be at least 0.5, and (b) all of the item loadings should exceed 0.7 (Hair et al., 2017). As illustrated in Table 3, all of the latent constructs exceeded the recommended thresholds. The AVE values ranged between 0.531 and 0.739, and all of the item loadings exceeded 0.7, indicating adequate convergent validity.

Discriminant validity is the degree to which a scale measures the variable it intends to measure. It is indicated by small correlations among the measures of interest and the measures of the other constructs (Fornell & Larcker, 1981). Discriminant validity is assessed using two criteria: (a) the heterotrait-monotrait ratio of correlations (HTMT), and (b) the square root of the AVE for each construct (Hair et al., 2017). The HTMT values for the reflective constructs ranged between 0.537 and 0.831, that is, below the conservative threshold value of 0.85. The square roots of each of the AVEs were larger than the correlations between the AVE and all of the other constructs (see Table 4), indicating adequate discriminant validity.

Assessment of formative constructs

Formative items are those that cause variance in the formative constructs under scrutiny (Bollen, 1984). Formative items neither correlate with one another nor exhibit internal consistency (Chin, 1998). Therefore, assessing the convergent validity and discriminant validity of formative constructs using the criteria for reflective constructs is not meaningful (Hair et al., 2017).

TABLE 3 Psychometric properties of the measures

Construct	Item	Loading	*t*-value	Mean	SD
Perceived positive mood enhancement Cronbach's alpha = .824; CR = 0.894; AVE = 0.739	PME1	0.838	50.320	5.318	1.197
	PME2	0.863	60.123	5.640	1.161
	PME3	0.879	67.090	5.591	1.182
Perceived negative mood reduction Cronbach's alpha = .771; CR = 0.866; AVE = 0.683	NMR1	0.821	38.997	5.103	1.290
	NMR2	0.823	43.301	5.544	1.224
	NMR3	0.841	43.418	5.382	1.178
MMORPG addiction (CCS) Cronbach's alpha = .859; CR = 0.887; AVE = 0.531	ADDCCS1	0.704	22.230	4.414	1.626
	ADDCCS2	0.745	27.178	4.345	1.733
	ADDCCS3	0.730	23.986	4.850	1.428
	ADDCCS4	0.759	27.165	4.719	1.494
	ADDCCS5	0.705	22.981	5.076	1.367
	ADDCCS6	0.702	18.648	4.180	1.800
	ADDCCS7	0.807	34.688	4.446	1.671
MMORPG addiction (BTAS) Cronbach's alpha = .943; CR = 0.952; AVE = 0.687	ADDBTAS1	0.786	9.983	4.333	1.786
	ADDBTAS2	0.846	11.124	4.268	1.800
	ADDBTAS3	0.799	9.083	4.517	1.657
	ADDBTAS4	0.855	14.013	3.951	1.835
	ADDBTAS5	0.864	13.384	3.968	1.850
	ADDBTAS6	0.869	14.671	4.022	1.889
	ADDBTAS7	0.833	12.572	3.943	1.957
	ADDBTAS8	0.823	11.636	4.200	1.854
	ADDBTAS9	0.782	8.240	4.256	1.872
MMORPG addiction (OCS) Cronbach's alpha = .976; CR = 0.978; AVE = 0.685	ADDOCS1	0.823	54.211	4.020	1.892
	ADDOCS2	0.861	63.320	3.966	1.885
	ADDOCS3	0.856	69.245	3.759	1.987
	ADDOCS4	0.837	54.188	4.007	1.881
	ADDOCS5	0.843	51.861	3.658	1.887
	ADDOCS6	0.739	30.829	4.468	1.735
	ADDOCS7	0.832	43.388	3.985	1.875
	ADDOCS8	0.842	52.910	3.825	1.924
	ADDOCS9	0.810	37.883	4.000	1.824
	ADDOCS10	0.802	40.380	3.603	1.958
	ADDOCS11	0.828	54.113	3.596	1.737
	ADDOCS12	0.867	64.946	3.522	1.741
	ADDOCS13	0.866	75.276	3.374	1.798
	ADDOCS14	0.848	57.548	3.589	1.724
	ADDOCS15	0.842	43.758	3.278	1.709
	ADDOCS16	0.748	33.789	3.980	1.648
	ADDOCS17	0.842	45.762	3.571	1.696

(Continues)

TABLE 3 (Continued)

Construct	Item	Loading	*t*-value	Mean	SD
	ADDOCS18	0.844	48.251	3.416	
	ADDOCS19	0.811	36.884	3.581	1.658
	ADDOCS20	0.802	34.095	3.259	1.769

Abbreviations: AVE, average variance extracted; BTAS, Behavioural Technology Addiction Scale; CCS, Compulsive Consumption Scale; CR, composite reliability; MMORPG, massively multiplayer online role-playing game; OCS, Obsessive-Compulsive Scale.

TABLE 4 Inter-construct correlation matrix with MMORPG addiction

	Mean	SD	1	2	3	4	5	6
CCS								
1. MMORPG addiction (CCS)	4.576	1.172	**0.735**					
2. Perceived positive mood enhancement	5.516	1.015	0.468	**0.860**				
3. Perceived negative mood reduction	5.343	1.019	0.434	0.662	**0.828**			
4. Achievement affordance	5.701	0.935	0.244	0.534	0.456	N/A		
5. Social affordance	5.780	0.969	0.232	0.545	0.472	0.733	N/A	
6. Immersion affordance	5.657	0.932	0.337	0.651	0.534	0.659	0.715	N/A
BTAS								
1. MMORPG addiction (BTAS)	4.162	1.521	**0.829**					
2. Perceived positive mood enhancement	5.516	1.015	0.291	**0.860**				
3. Perceived negative mood reduction	5.343	1.019	0.273	0.662	**0.828**			
4. Achievement affordance	5.701	0.935	0.079	0.534	0.452	N/A		
5. Social affordance	5.780	0.969	0.073	0.544	0.470	0.737	N/A	
6. Immersion affordance	5.657	0.932	0.156	0.651	0.531	0.667	0.723	N/A
OCS								
1. MMORPG addiction (OCS)	3.722	1.493	**0.828**					
2. Perceived positive mood enhancement	5.516	1.015	0.259	**0.860**				
3. Perceived negative mood reduction	5.343	1.019	0.288	0.662	**0.828**			
4. Achievement affordance	5.701	0.935	0.020	0.535	0.451	N/A		
5. Social affordance	5.780	0.969	−0.005	0.544	0.469	0.737	N/A	
6. Immersion affordance	5.657	0.932	0.093	0.651	0.530	0.669	0.725	N/A

Note: Items on the diagonal represent the square roots of AVEs (indicated in bold).
Abbreviations: AVE, average variance extracted; BTAS, Behavioural Technology Addiction Scale; CCS, Compulsive Consumption Scale; MMORPG, massively multiplayer online role-playing game; OCS, Obsessive-Compulsive Scale.

The assessment of convergent validity involves redundancy analysis to determine whether the formative construct is highly correlated with its reflective global measure (Hair et al., 2017). The results of the analysis showed that the path coefficient for each affordance (ie, achievement, social and immersion affordances) was higher than 0.7, contributing sufficiently to the intended affordance and indicating adequate convergent validity.

We then assessed multicollinearity for the formative items. As formative constructs are predicted jointly by multiple indicators in an analogous fashion, multicollinearity is a major concern. However, multicollinearity was not an issue in our study because (a) none of the bivariate correlations exceeded 0.9 (Tabachnick & Fidell, 2001); (b) the

TABLE 5 Item weights and loadings of formative constructs

Construct	Item	VIF	Weight	*t*-value	Loading	*t*-value	Mean	SD
Achievement affordance	ACH1	1.816	0.223	2.200	0.782	14.506	5.667	1.118
	ACH2	1.944	0.309	2.945	0.829	17.011	5.687	1.181
	ACH3	1.857	0.403	4.049	0.863	21.733	5.631	1.224
	ACH4	1.927	0.271	2.138	0.819	15.843	5.778	1.100
Social affordance	SOC1	1.918	0.181	1.798	0.778	15.568	5.766	1.138
	SOC2	1.993	0.329	3.499	0.849	21.188	5.761	1.174
	SOC3	2.281	0.345	3.454	0.878	25.175	5.837	1.092
	SOC4	2.025	0.326	2.860	0.852	19.640	5.756	1.198
Immersion affordance	IMM1	1.401	0.387	5.360	0.779	17.452	5.426	1.143
	IMM2	2.158	0.320	3.995	0.838	24.475	5.714	1.191
	IMM3	1.816	0.258	3.248	0.775	17.845	5.835	1.120
	IMM4	1.782	0.289	3.682	0.800	19.974	5.653	1.205

Abbreviation: VIF, variance inflation factor.

tolerance values averaged more than 0.3; and (c) the maximum variance inflation factor (VIF) was 2.281, below the prescriptive diagnostic of 3.3 (Hair et al., 2017).

Finally, we examined the item weights, loadings and significances of the formative items (Hair et al., 2017). As illustrated in Table 5, the weights and loadings for all of the items were statistically significant (except the weight of SOC1, which was marginally significant), indicating that all of the measurement items made relative and absolute contributions to the formative constructs of MMORPG affordances. These results suggested that all of the formative items should be retained for the subsequent model analyses (Hair et al., 2017).

5.2.2 | Structural model

Table 6 summarises the results of the structural model testing with the three MMORPG addiction scales. We performed bootstrapping with 5000 subsamples to test the significance levels of the path coefficients in the research model (Hair et al., 2017). The research model explained a substantial amount of the variance in the dependent variables. In particular, the model explained 44.3% of the variance of perceived positive mood enhancement, 30.3% of the variance of perceived negative mood reduction, and between 16.6% and 29.7% of the variance of MMORPG addiction depending on the adopted measurement scales. Figure 2 summarises the results.

The obtained path coefficients and levels of significance indicated that the majority of the hypotheses were supported. Perceived positive mood enhancement had positive and significant relationships with the extent of MMORPG addiction (β_{CCS} = .287, P < .001; β_{BTAS} = .190, P < .01; β_{OCS} = .121, P < .05), supporting H1. Perceived negative mood reduction had positive and significant relationships with the extent of MMORPG addiction (β_{CCS} = .209, P < .001; β_{BTAS} = .138, P < .05; β_{OCS} = .193, P < .001), supporting H2.

Achievement affordance had positive and significant relationships with perceived positive mood enhancement (β = .146, P < .05) and perceived negative mood reduction (β = .123, P < .05), supporting H3a and H3b. Immersion affordance had positive and significant relationships with perceived positive mood enhancement (β = .499, P < .001) and perceived negative mood reduction (β = .364, P < .001), supporting H5a and H5b. However, social affordance had no significant relationships with perceived positive mood enhancement (β = .074, P > .05) or perceived negative mood reduction (β = .114, P > .05), failing to support H4a and H4b.

TABLE 6 Result of the structural model

Hypothesis		MMORPG Addiction scale			Supported (Yes/No)
		CCS	BTAS	OCS	
H1	Perceived positive mood enhancement → the extent of MMORPG addiction	0.287***	0.190**	0.121*	Yes
H2	Perceived negative mood reduction → the extent of MMORPG addiction	0.209***	0.138*	0.193***	Yes
H3a	Achievement affordance → Perceived positive mood enhancement	0.147*	0.146*	0.146*	Yes
H3b	Achievement affordance → Perceived negative mood reduction	0.124*	0.124*	0.123*	Yes
H4a	Social affordance → Perceived positive mood enhancement	$0.074^{n.s.}$	$0.074^{n.s.}$	$0.074^{n.s.}$	No
H4b	Social affordance → Perceived negative mood reduction	$0.115^{n.s.}$	$0.114^{n.s.}$	$0.114^{n.s.}$	No
H5a	Immersion affordance → Perceived positive mood enhancement	0.499***	0.499***	0.499***	Yes
H5b	Immersion affordance → Perceived negative mood reduction	0.364***	0.365***	0.365***	Yes
R^2	Perceived positive mood enhancement	0.443	0.443	0.443	
	Perceived negative mood reduction	0.303	0.303	0.302	
	MMORPG addiction	0.297	0.166	0.216	

Note: $^{n.s.}$Non-significant.
Abbreviations: BTAS, Behavioural Technology Addiction Scale; CCS, Compulsive Consumption Scale; MMORPG, massively multiplayer online role-playing game; OCS, Obsessive-Compulsive Scale.
*$P < .05$.
**$P < .01$.
***$P < .001$.

6 | DISCUSSION AND IMPLICATIONS

MMORPG addiction is a serious issue worldwide and attracting an increasing amount of attention from the public, governments and the academic community. To address this critical issue and the research gaps, we integrate the hedonic management model of addiction (Brown, 1997) and the technology affordance perspective (Markus & Silver, 2008) to develop a research model that explains the psychological mechanisms underlying MMORPG addiction. In particular, we examine the relationships between MMORPG-specific affordances (ie, achievement affordance, social affordance and immersion affordance) and the duality of hedonic effects (ie, perceived positive mood enhancement and perceived negative mood reduction), and how they correlate with the extent of MMORPG addiction. In the following subsections, we discuss our findings and highlight the implications for research and practice. We conclude the article by addressing limitations and suggesting future research directions.

6.1 | Discussions of results

We empirically test the research model with 406 responses from MMORPG players. Our empirical findings provide strong support for most of our hypotheses. We find that both perceived positive mood enhancement and perceived negative mood reduction positively correlate with the extent of MMORPG addiction, confirming the salient role of

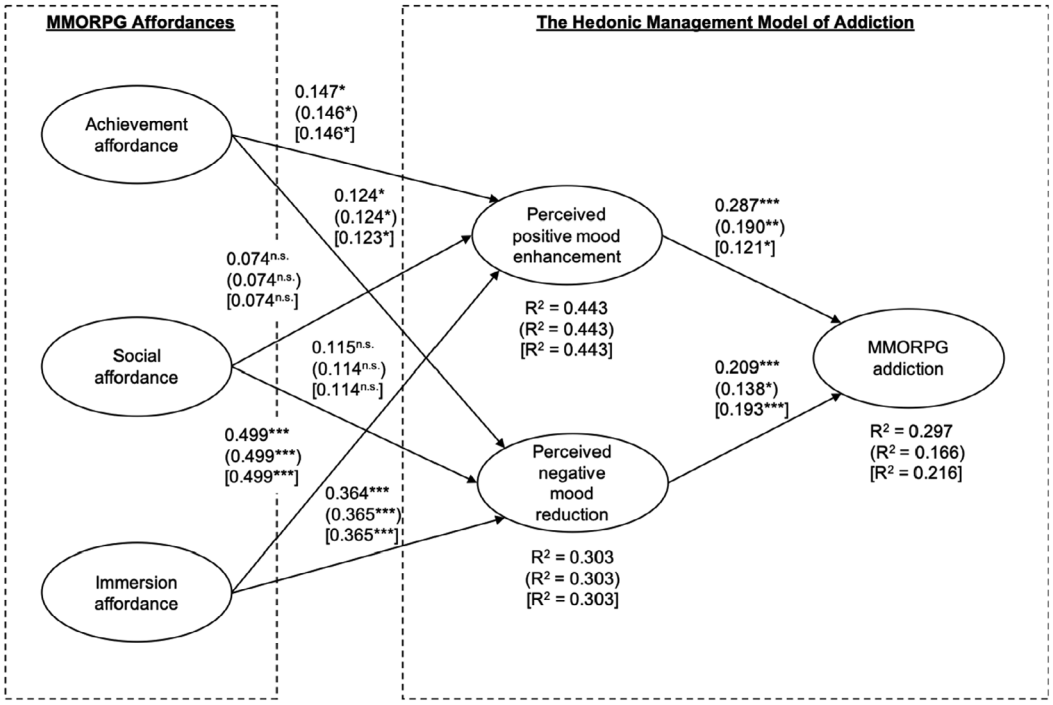

FIGURE 2 Research results. Results with the Compulsive Consumption Scale (CCS) are shown without brackets; results with the Behavioural Technology Addiction Scale (BTAS) are shown in round brackets; results with the Obsessive-Compulsive Scale (OCS) are shown in square brackets. $^{n.s.}$non-significant, $^{*}P < .05$, $^{**}P < .01$, $^{***}P < .001$

the duality of hedonic effects in such an addiction. Furthermore, we find that only achievement affordance and immersion affordance have significant and positive relationships with perceived positive mood enhancement and perceived negative mood reduction. Immersion affordance exhibits the strongest relationships. This result can perhaps be explained by the unique nature of MMORPGs, as they present a never-ending immersive virtual world wherein players can role-play and customise their in-game characters, interact with other players and explore a virtual world through their characters. This immersive gaming experience is well recognised as a core element of the MMORPG genre (Barnett & Coulson, 2010).

However, our results show that social affordance does not have significant relationships with either perceived positive mood enhancement or perceived negative mood reduction. We have several possible explanations for these unexpected findings. First, some players might use technologies extraneous to the online games—such as Discord, a free voice and text chat application for gamers (Discordapp.com, 2020)—for social connections and interactions. Second, we suspect that the findings might be attributable to the specific genre of massively multiplayer online games. For instance, immersive affordance has the strongest relationships with perceived positive mood enhancement and perceived negative mood reduction in MMORPGs that feature role-playing with in-game characters and in which exploring virtual worlds is one of the core activities. In contrast, achievement affordance might assume a more predominant role in massively multiplayer online first-person shooter games that endow players with a sense of achievement and a sense of control over their environment and destiny (Konnikova, 2013). Such findings might be attributable to the foci or types of different MMORPGs. For example, WoW tends to encourage competitive play, and thus achievement affordance might have stronger relationships with perceived positive mood enhancement and perceived negative mood reduction. Meanwhile, MMORPGs such as Eve Online tend to encourage cooperative play, and thus social affordance might have stronger relationships with positive mood enhancement and perceived

negative mood reduction instead. Our findings suggest promising opportunities for future research to examine the variation in player behaviour across different types and genres of online games.

Additionally, we find that two control variables—age and experience—are negatively correlated with the extent of MMORPG addiction. The greater the age and the greater the experience of the players, the less prone they are to MMORPG addiction. This finding raises concerns that teenagers, young adults, and less experienced players are more vulnerable to MMORPG addiction than other game players. This study's results are noteworthy for researchers, policymakers and practitioners. The implications are further discussed below.

6.2 | Implications for research

This study advances the literature on MMORPG addiction, online gaming addiction, and technology addiction in several ways. First, in our literature review, we find that most existing studies on MMORPG addiction are from the literature on clinical psychology, medical and psychiatry and focus on diagnostic aspects, with little attention paid to the psychological mechanisms underlying this type of addiction. Our study contributes to the growing literature on MMORPG addiction and technology addiction by proposing and testing a research model that explains the psychological mechanisms influencing MMORPG addiction. Furthermore, our research makes a cross-disciplinary contribution to both the information systems literature and the MMORPG literature. We use the concepts and theoretical lenses of both disciplines—that is, the hedonic management model of addiction and the technology affordance perspective—to produce interactional insights that enrich both (Tarafdar & Davison, 2018).

Second, obtaining a good hedonic tone (ie, states of relative pleasure and euphoria) lies at the root of behavioural addictions (Brown, 1997). As such, the duality of hedonic effects (ie, perceived positive mood enhancement and perceived negative mood reduction) should play a crucial role in MMORPG addiction. The relationships between the duality of hedonic effects and the extent of MMORPG addiction have not been systematically examined in the extant literature. Our study contributes by revealing the previously overlooked importance of the duality of hedonic effects on MMORPG addiction, and invites future studies to systematically examine how the duality of hedonic effects influences addiction to other hedonic technologies.

Third, prior studies of MMORPG addiction focus on its aetiology, pathology and ramification. However, the effects of contextual factors on the extent of MMORPG addiction are poorly understood. The inclusion of technology- or context-specific variables has been consistently called for in general IS research (Hong et al., 2014) and in technology addiction research (Turel, Serenko, & Giles, 2011). We extend the hedonic management model of addiction with the technology affordance perspective to provide a contextualised theoretical contribution to the technology addiction literature. This contribution is particularly important and relevant to IS research. Our model offers an alternative perspective on the mutuality between players and the MMORPG affordances and their roles in MMORPG addiction. In terms of affordance, the specific MMORPG feature is not important in and of itself; rather, it is only important insomuch as it affords the action possibilities of achieving, socialising, and immersing oneself—possibilities that in turn affect the mood-modifying abilities that players believe are caused by playing MMORPGs. The affordance approach avoids privileging any single specific component of the MMORPG over any other component in explaining MMORPG addiction, and it forces researchers to consider the mutuality between the action to be taken and the technology's capability. On these merits, we incorporate the technology affordance perspective into our model and advocate its use in future research on technology addiction to better capture how action possibilities afforded by technologies are associated with technology addiction. Finally, although most prior studies associate affordances with positive behaviours (Majchrzak et al., 2013; Strong et al., 2014), there is little understanding of the role affordances play in explaining undesirable IS use behaviours. We expect that our results will offer an alternative perspective on the far-reaching, unintended effects of technological affordances as a potential enabler of addictive technology use.

6.3 | Implications for practice

This study has several important implications for practitioners and policymakers. Our findings show that achievement and immersion affordances are positively correlated with mood-modifying abilities, whereas social affordance does not exhibit any significant effect. These findings offer MMORPG developers insights into designing preventive functionalities within MMORPGs. In relation to achievement affordance, MMORPG developers might, for example, consider introducing a voluntary fatigue system, also known as a reward reducing system, that would gradually reduce gained experiences and skill points for players after a certain time limit or prolonged gaming. When players experience some symptoms of MMORPG addiction, they could voluntarily make use of the fatigue system to manage their MMORPG use. The fatigue system might reduce the players' perceived achievement affordance in the gameplay, potentially dissuading them from engaging in potentially dangerous marathon gaming sessions. In relation to immersion affordance, MMORPG developers might, for example, consider introducing alternative login servers that allow players to voluntarily limit the amount of time spent in each gaming episode. Through this functionality, players can log in through a server that limits each gaming episode to 2 hours per day. Such a preventive functionality might reduce the players' perceived immersion affordance from playing MMORPGs. However, we acknowledge that introducing such preventive functionalities to MMORPGs might reduce the players' satisfaction, which in turn could hurt gaming companies' revenue. Game developers are advised to make such preventive functionalities voluntary for players. Thus, players who perceive themselves as vulnerable to MMORPG addiction can make use of such functionalities. Other players, such as those who can regulate their gameplay and/or experience no negative consequences, can continue their usual gaming patterns and derive maximum joy from playing MMORPGs.

Our findings also offer psychiatrists insights into possibilities for developing intervention programmes. As seen in the hedonic management model of addiction, players who regard playing MMORPGs as a desirable, useful activity for obtaining a good hedonic tone might repeatedly play the games. Therefore, the success of intervention programmes hinges on helping players identify alternative hedonic sources and activities that are capable of enhancing their positive mood and/or reducing their negative mood. As MMORPGs are tied to computers and mobiles, they become a key part of our daily lives in the digital era. Therefore, the vector of MMORPG addiction might be difficult or impossible for individuals to avoid. As such, intervention programmes should aim to promote and diversify alternative hedonic sources, rather than to propose abstinence. Intervention programmes should aim to stem MMORPG addiction through reducing the players' reliance on playing MMORPGs for mood management.

Our findings show that age is negatively correlated with the extent of MMORPG addiction. Compared with older players, young players are more susceptible to MMORPG addiction, which might be attributable to younger individuals' relatively lower capacity to self-monitor and self-regulate(Mischel & Mischel, 1983). Policymakers and governments should consider enforcing laws and regulations that limit gaming for these vulnerable groups of players. The South Korean government, for example, implemented the Youth Protection Revision Act, also known as the Shutdown Law or Cinderella Law, which forbids those under the age of 16 from playing online games between the hours of 00:00 and 06:00.

6.4 | Limitations and directions for future research

We acknowledge that this study has a few limitations, which might nevertheless lead to other fruitful research avenues.

6.4.1 | Cooperative play vs competitive play

We tested our research model by performing a multiple-group analysis that compared subsamples of cooperative play, competitive play and cooperative play with elements of competitive play, respectively. No significant

differences were observed. We suspect that this is because MMORPGs are well blended with a variety of structural characteristics that provide players with a holistically hedonic gaming experience. According to Yee (2006b), in MMORPGs, the achievement component consists of the subcomponents of advancement, mechanics, and competition; the social component consists of the subcomponents of socialising, relationships, and teamwork; and the immersion component consists of the subcomponents of discovery, role-playing, customisation and escapism. It is possible that no single structural characteristic or associated affordance has a dominant role in MMORPG gameplay. Rather, these characteristics and affordances work together to provide players with a holistic gaming experience. We believe that types of play would be found to affect addiction if they were tested across different online genres in which cooperative play or competitive play had a dominant role in the gameplay. For instance, massively multiplayer online racing games have a strong focus on competitive play, whereas massively multiplayer online social games have a strong focus on cooperative play. Future studies should examine the differences between cooperative play and competitive play across online game genres, and evaluate their relative effects on addiction.

6.4.2 | Generalisability

This study's results might be generalisable to MMORPG players only. Future research should replicate and validate the theoretical model for other hedonic technologies to improve the generalisability of the model. Future research should also, following the approach adopted in this study, examine context-specific variables to provide a more accurate depiction of the technologies of interest. For instance, the variables of immersion and achievement affordances are specific to MMORPGs and might not apply to other hedonic technologies, such as social networking sites.

6.4.3 | Alternative platforms

MMORPGs, which provide gameplay in three-dimensional and never-ending virtual worlds, have traditionally required players to preinstall software clients on computers that meet certain hardware and software requirements. In the past, MMORPG players were often restrained by location. However, advances in mobile technology and data services have enabled players to play MMORPGs at anytime and anywhere, increasing the risk of addiction. Future research should explore the influence of additional contextual factors, such as mobility and accessibility, on MMORPG addiction.

6.4.4 | Alternative theoretical frameworks

This study investigates MMORPG addiction from the hedonic management and technology affordance perspectives and highlights the role of the duality hedonic effects. Although such perspectives shed new light on MMORPG addiction, alternative theoretical frameworks should be explored. For instance, as age and gaming experience are found to be negatively correlated to the extent of MMORPG addiction, researchers should consider alternative theoretical frameworks—such as self-regulationtheory—to explain the other psychological mechanisms underlying MMORPG addiction.

ACKNOWLEDGEMENTS

The authors wish to thank the editor-in-chief, Prof. Davison, the senior editor, the associate editor, and the three reviewers for their support and guidance throughout the review process. The work described in this article was partially supported by a grant from the National Natural Science Foundation of China (NSFC) (Project no.: 71828202).

ORCID

Zach W. Y. Lee https://orcid.org/0000-0003-1118-5701

Christy M. K. Cheung https://orcid.org/0000-0003-4411-0570

Tommy K. H. Chan https://orcid.org/0000-0001-9930-8897

ENDNOTES

[1]The range varies because of the assessment method: 3.6% are based on a monothetic assessment method in which all seven diagnostic criteria are met, and 44.5% are based on a polythetic assessment method in which four out of seven diagnostic criteria are met. The MMORPG addiction rate is estimated from a sample of 1420 players from multiple countries, including the United States (46.4%), the United Kingdom (14.8%), Canada (6.3%), Australia (4.2%) and Finland (2.9%). The remainder of the sample (13.2%) includes New Zealand, Greece, Norway, the Netherlands, Germany, Poland, Sweden and Japan (see Hussain, Griffiths, & Baguley, 2012).

[2]This study focuses on investigating the correlations between antecedents and the extent of MMORPG addiction (as a psychological state of maladaptive dependency on playing MMORPGs), we used validated research scales as opposed to clinical diagnosis criteria to measure MMORPG addiction.

REFERENCES

Al-Natour, S., & Benbasat, I. (2009). The adoption and use of IT artifacts: A new interaction-centric model for the study of user-artifact relationships. *Journal of the Association for Information Systems*, *10*(9), 661–685. https://doi.org/10.17705/1jais.00208

Babalon, M. (2020). Top 6 most popular MMORPGs sorted by population (2020). Retrieved from https://altarofgaming.com/all-mmos-sorted-by-population-2018/

Bacchini, D., De Angelis, G., & Fanara, A. (2017). Identity formation in adolescent and emerging adult regular players of massively multiplayer online role-playing games (MMORPG). *Computers in Human Behavior*, *73*, 191–199. https://doi.org/10.1016/j.chb.2017.03.045

Bargeron, A. H., & Hormes, J. M. (2017). Psychosocial correlates of internet gaming disorder: Psychopathology, life satisfaction, and impulsivity. *Computers in Human Behavior*, *68*, 388–394. https://doi.org/10.1016/j.chb.2016.11.029

Barnett, J., & Coulson, M. (2010). Virtually real: A psychological perspective on massively multiplayer online games. *Review of General Psychology*, *14*(2), 167–179. https://doi.org/10.1037/a0019442

Berczik, K., Griffiths, M. D., Szabó, A., Kurimay, T., Kökönyei, G., Urbán, R., & Demetrovics, Z. (2014). Exercise addiction – The emergence of a new disorder. *Australasian Epidemiologist*, *21*(2), 36–40.

Billieux, J., Chanal, J., Khazaal, Y., Rochat, L., Gay, P., Zullino, D., & Van der Linden, M. (2011). Psychological predictors of problematic involvement in massively multiplayer online role-playing games: Illustration in a sample of male cybercafe players. *Psychopathology*, *44*(3), 165–171. https://doi.org/10.1159/000322525

Blasi, M. D., Giardina, A., Giordano, C., Coco, G. L., Tosto, C., Billieux, J., & Schimmenti, A. (2019). Problematic video game use as an emotional coping strategy: Evidence from a sample of MMORPG gamers. *Journal of Behavioral Addictions*, *8*(1), 25–34. https://doi.org/10.1556/2006.8.2019.02

Bollen, K. A. (1984). Multiple indicators: Internal consistency or no necessary relationship?*Quality and Quantity*, *18*(4), 377–385. https://doi.org/10.1007/BF00227593

Brown, I. (1993). Some contributions of the study of gambling to the study of other addictions. In W. R. Eadingto & J. A. Cornelius(Eds.), *Gambling behavior and problem gambling*. Reno: University of Nevada.

Brown, I. (1997). A theoretical model of the behavioural addictions – Applied to offending. In J. Hodge, M. McMurran, & C. R. Hollin(Eds.), *Addicted to crime?* (pp. 16–63). Chichester, England: Wiley.

Byun, S., Niang, M., & Lee, J.-K. (2009). Internet addiction: Metasynthesis of 1996–2006 quantitative research. *Cyberpsychology & Behavior*, *12*(2), 203–207. https://doi.org/10.1089/cpb.2008.0102

Caplan, S. E. (2010). Theory and measurement of generalized problematic internet use: A two-step approach. *Computers in Human Behavior*, *26*(5), 1089–1097. https://doi.org/10.1016/j.chb.2010.03.012

Chan, T. K. H., Cheung, C. M. K., & Wong, R. Y. M. (2019). Cyberbullying on social networking sites: The crime opportunity and affordance perspectives. *Journal of Management Information Systems*, *36*(2), 574–609. https://doi.org/10.1080/07421222.2019.1599500

Charlton, J. P. (2002). A factor-analytic investigation of computer "addiction" and engagement. *British Journal of Psychology*, *93*(3), 329–344. https://doi.org/10.1348/000712602760146242

Charlton, J. P., & Danforth, I. D. (2007). Distinguishing addiction and high engagement in the context of online game playing. *Computers in Human Behavior*, *23*(3), 1531–1548. https://doi.org/10.1016/j.chb.2005.07.002

Charlton, J. P., & Danforth, I. D. W. (2010). Validating the distinction between computer addiction and engagement: Online game playing and personality. *Behaviour & Information Technology*, *29*(6), 601–613. https://doi.org/10.1006/ijhc.2000.0400

Chatterjee, S., Moody, G., Lowry, P. B., Chakraborty, S., & Hardin, A. (2015). Strategic relevance of organizational virtues enabled by information technology in organizational innovation. *Journal of Management Information Systems*, *32*(3), 158–196. https://doi.org/10.1080/07421222.2014.1001257

Chen, C., Zhang, K. Z. K., Gong, X., Zhao, S. J., Lee, M. K. O., & Liang, L. (2017). Examining the effects of motives and gender differences on smartphone addiction. *Computers in Human Behavior*, *75*, 891–902. https://doi.org/10.1016/j.chb.2017.07.002

Chin, W. W. (1998). Issues and opinion on structural equation modeling. *MIS Quarterly*, *22*(1), vii–xvi.

Clark, N. L. (2006). *Addiction and the structural characteristics of massively multiplayer online games* (master's thesis). University of Hawaii. Retrieved from https://www.gamasutra.com/features/20060822/vgsca_gama.pdf

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, *98*(2), 310–357. https://doi.org/10.1037/0033-2909.98.2.310

Cole, H., & Griffiths, M. D. (2007). Social interactions in massively multiplayer online role-playing gamers. *Cyberpsychology & Behavior*, *10*(4), 575–583. https://doi.org/10.1089/cpb.2007.9988

Crenshaw, N., & Nardi, B. (2016). *"It was more than just the game, it was the community": Social affordances in online games*. Paper presented at the 49th Hawaii International Conference on System Sciences (HICSS), Kauai, Hawaii.

Discordapp.com. (2020). A new way to chat with your communities and friends. Retrieved from https://discordapp.com/

Dong, G., & Potenza, M. N. (2014). A cognitive-behavioral model of internet gaming disorder: Theoretical underpinnings and clinical implications. *Journal of Psychiatric Research*, *58*, 7–11. https://doi.org/10.1016/j.jpsychires.2014.07.005

Elhai, J. D., Dvorak, R. D., Levine, J. C., & Hall, B. J. (2017). Problematic smartphone use: A conceptual overview and systematic review of relations with anxiety and depression psychopathology. *Journal of Affective Disorders*, *207*, 251–259. https://doi.org/10.1016/j.jad.2016.08.030

Flora, S. R. (2012). *The power of reinforcement*. Albany, NY: SUNY Press.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.2307/3151312

Gilbert, B. (2015). Against all odds, 'world of warcraft' still has over 7 million players. Retrieved from http://uk.businessinsider.com/world-of-warcraft-still-has-over-7-million-players-2015-5?r=US&IR=T

GlobalWebIndex. (2018). *Globalwebindex's flagship report on the latest trends in entertainment*. Retrieved from https://www.globalwebindex.com/hubfs/Downloads/Entertainment-q1-2019-report.pdf

Gong, X., Zhang, K. Z. K., Cheung, C. M. K., Chen, C., & Lee, M. K. O. (2019). Alone or together? Exploring the role of desire for online group gaming in players' social game addiction. *Information & Management*, *56*(6), 103–139. https://doi.org/10.1016/j.im.2019.01.001

Goodman, A. (1990). Addiction: Definition and implications. *British Journal of Addiction*, *85*(11), 1403–1408. https://doi.org/10.1111/j.1360-0443.1990.tb01620.x

Grgecic, D., Holten, R., & Rosenkranz, C. (2015). The impact of functional affordances and symbolic expressions on the formation of beliefs. *Journal of the Association for Information Systems*, *16*(7), 580–607. https://doi.org/10.17705/1jais.00402

Hagström, D., & Kaldo, V. (2014). Escapism among players of mmorpgs—Conceptual clarification, its relation to mental health factors, and development of a new measure. *Cyberpsychology, Behavior and Social Networking*, *17*(1), 19–25. https://doi.org/10.1089/cyber.2012.0222

Hair, J. J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). Thousand Oaks, CA: Sage.

Harman, H. H. (1976). *Modern factor analysis* (3rd ed.). Chicago, IL: The University of Chicago Press.

Hoehle, H., & Venkatesh, V. (2015). Mobile application usability: Conceptualization and instrument development. *MIS Quarterly*, *39*(2), 435–472. https://doi.org/10.25300/MISQ/2015/39.2.08

Hong, W. Y., Chan, F. K. Y., Thong, J. Y. L., Chasalow, L. C., & Dhillon, G. (2014). A framework and guidelines for context-specific theorizing in information systems research. *Information Systems Research*, *25*(1), 111–136. https://doi.org/10.1287/isre.2013.0501

Hsu, S. H., Wen, M.-H., & Wu, M.-C. (2009). Exploring user experiences as predictors of mmorpg addiction. *Computers & Education*, *53*(3), 990–999. https://doi.org/10.1089/cpb.2007.9991

Hu, J., Zhen, S., Yu, C., Zhang, Q., & Zhang, W. (2017). Sensation seeking and online gaming addiction in adolescents: A moderated mediation model of positive affective associations and impulsivity. *Frontiers in Psychology*, *8*, 699. https://doi.org/10.3389/fpsyg.2017.00699

Hussain, Z., & Griffiths, M. D. (2009a). The attitudes, feelings, and experiences on online gamers: A qualititative analysis. *Cyberpsychology & Behavior*, *12*(6), 747–753. https://doi.org/10.1089/cpb.2009.0059

Hussain, Z., & Griffiths, M. D. (2009b). Excessive use of massively multi-player online role-playing games: A pilot study. *International Journal of Mental Health and Addiction*, *7*(4), 563–571. https://doi.org/10.1089/cpb.2006.9956

Hussain, Z., & Griffiths, M. D. (2014). A qualitative analysis of online gaming: Social interaction, community, and game design. *International Journal of Cyber Behavior, Psychology and Learning*, *4*(2), 41–57. https://doi.org/10.4018/978-1-4666-8200-9.ch014

Hussain, Z., Griffiths, M. D., & Baguley, T. (2012). Online gaming addiction: Classification, prediction and associated risk factors. *Addiction Research & Theory*, *20*(5), 359–371. https://doi.org/10.3109/16066359.2011.640442

Hyun, G. J., Han, D. H., Lee, Y. S., Kang, K. D., Yoo, S. K., Chung, U.-S., & Renshaw, P. F. (2015). Risk factors associated with online game addiction: A hierarchical model. *Computers in Human Behavior*, *48*, 706–713. https://doi.org/10.1016/j.chb.2015.02.008

James, T. L., Lowry, P. B., Wallace, L., & Warkentin, M. (2017). The effect of belongingness on obsessive-compulsive disorder in the use of online social networks. *Journal of Management Information Systems*, *34*(2), 560–596. https://doi.org/10.1080/07421222.2017.1334496

Jia, R., & Jia, H. H. (2008). *Computer playfulness, personal innovativeness, and problematic technology use: A new measure and some initial evidence*. Paper presented at the International Conference on Information Systems, Paris, France.

Kerr, J. H., Lindner, K. J., & Blaydon, M. (2008). *Exercise dependence*. London, England: Taylor & Francis.

Kim, P. W., Kim, S. Y., Shim, M., Im, C.-H., & Shon, Y.-M. (2013). The influence of an educational course on language expression and treatment of gaming addiction for massive multiplayer online role-playing game (MMORPG) players. *Computers & Education*, *63*, 208–217. https://doi.org/10.1016/j.compedu.2012.12.008

Kirby, A., Jones, C., & Copello, A. (2014). The impact of massively multiplayer online role playing games (MMORPGs) on psychological wellbeing and the role of play motivations and problematic use. *International Journal of Mental Health and Addiction*, *12*(1), 36–51. https://doi.org/10.1007/s11469-013-9467-9

Konnikova, M. (2013). Why gamers can't stop playing first-person shooters. Retrieved from https://www.newyorker.com/tech/elements/why-gamers-cant-stop-playing-first-person-shooters

Laier, C., Pawlikowski, M., Pekal, J., Schulte, F. P., & Brand, M. (2013). Cybersex addiction: Experienced sexual arousal when watching pornography and not real-life sexual contacts makes the difference. *Journal of Behavioral Addictions*, *2*(2), 100–107. https://doi.org/10.1556/JBA.2.2013.002

Lee, A. (2013, January). *21-year-old chinese gamer dies after 40-hour MMO session*. TechnoBuffalo. Retrieved from http://www.technobuffalo.com/2013/01/18/21-year-old-chinese-gamer-dies-after-40-hour-mmo-session/

Lee, J.-Y., Ko, D. W., & Lee, H. (2019). Loneliness, regulatory focus, inter-personal competence, and online game addiction. *Internet Research*, *29*(2), 381–394. https://doi.org/10.1108/IntR-01-2018-0020

Lee, Z. W. Y., Cheung, C. M. K., & Chan, T. K. H. (2015). Massively multiplayer online games addiction: Instrument development and validation. *Information & Management*, *52*(4), 413–430. https://doi.org/10.1016/j.im.2015.01.006

Leonardi, P. M. (2013). When does technology use enable network change in organizations? A comparative study of feature use and shared affordances. *MIS Quarterly*, *37*(3), 749–775. https://doi.org/10.25300/MISQ/2013/37.3.04

Li, Q., Guo, X., & Bai, X. (2017). Weekdays or weekends: Exploring the impacts of microblog posting patterns on gratification and addiction. *Information & Management*, *54*(5), 613–624. https://doi.org/10.1016/j.im.2016.12.004

Lindell, M. K., & Whitney, D. J. (2001). Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology*, *86*(1), 114–121. https://doi.org/10.1037/0021-9010.86.1.114

Lukavska, K. (2012). Time perspective as a predictor of massive multiplayer online role-playing game playing. *Cyberpsychology, Behavior and Social Networking*, *15*(1), 50–54. https://doi.org/10.1089/cyber.2011.0171

MacKenzie, S. B., Podsakoff, P. M., & Podsakoff, N. P. (2011). Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques. *MIS Quarterly*, *35*(2), 293–334. https://doi.org/10.2307/23044045

Majchrzak, A., Faraj, S., Kane, G. C., & Azad, B. (2013). The contradictory influence of social media affordances on online communal knowledge sharing. *Journal of Computer-Mediated Communication*, *19*(1), 38–55. https://doi.org/10.1111/jcc4.12030

Mancini, T., & Sibilla, F. (2017). Offline personality and avatar customisation. Discrepancy profiles and avatar identification in a sample of MMORPG players. *Computers in Human Behavior*, *69*, 275–283. https://doi.org/10.1016/j.chb.2016.12.031

Manne, S. L., & Zautra, A. J. (1989). Spouse criticism and support: Their association with coping and psychological adjustment among women with rheumatoid arthritis. *Journal of Personality and Social Psychology*, *56*(4), 608–617. https://doi.org/10.1037/0022-3514.56.4.608

Markus, M. L., & Silver, M. S. (2008). A foundation for the study of it effects: A new look at desanctis and poole's concepts of structural features and spirit. *Journal of the Association for Information Systems*, *9*(10), 609–632. https://doi.org/10.17705/1jais.00176

Meghdad, M. (2016). *Interactive affordances and player experience in massively multiplayer online role playing games: Exploration of world of warcraft players' experiences* (doctoral thesis). Nanyang Technological University. Retrieved from https://hdl.handle.net/10356/65976

Mehroof, M., & Griffiths, M. D. (2010). Online gaming addiction: The role of sensation seeking, self-control, neuroticism, aggression, state anxiety, and trait anxiety. *Cyberpsychology, Behavior and Social Networking*, *13*(3), 313–316. https://doi.org/10.1089/cyber.2009.0229

Mischel, H. N., & Mischel, W. (1983). The development of children's knowledge of self-control strategies. *Child Development*, *54*(3), 603–619. https://doi.org/10.1007/978-3-642-70967-8_22

Muñoz-Rivas, M. J., Fernández, L., & Gámez-Guadix, M. (2010). Analysis of the indicators of pathological internet use in Spanish university students. *The Spanish Journal of Psychology*, *13*(2), 697–707. https://doi.org/10.1017/s1138741600002365

Norman, D. A. (1998). *The invisible computer: Why good products can fail, the personal computer is so complex, and information appliances are the solution*. Cambridge, MA: MIT Press.

Nyamadi, M., & Boateng, R. (2018). *The influence of IT artifacts on players leading to Internet gaming addiction among university students in Africa*. Paper presented at the 24th Americas Conference on Information Systems, New Orleans.

Pavlou, P. A., Liang, H. G., & Xue, Y. J. (2007). Understanding and mitigating uncertainty in online exchange relationships: A principal-agent perspective. *MIS Quarterly*, *31*(1), 105–136. https://doi.org/10.2307/25148783

Quandt, T., & Kröger, S. (2014). *Multiplayer: The social aspects of digital gaming*. London, England: Routledge.

Quinones, C., & Kakabadse, N. K. (2015). Self-concept clarity, social support, and compulsive internet use: A study of the US and the UAE. *Computers in Human Behavior*, *44*, 347–356. https://doi.org/10.1016/j.chb.2014.11.019

Ridgway, N. M., Kukar-Kinney, M., & Monroe, K. B. (2008). An expanded conceptualization and a new measure of compulsive buying. *Journal of Consumer Research*, *35*(4), 622–639. https://doi.org/10.1086/591108

Rieger, D., Wulf, T., Kneer, J., Frischlich, L., & Bente, G. (2014). The winner takes it all: The effect of in-game success and need satisfaction on mood repair and enjoyment. *Computers in Human Behavior*, *39*, 281–286. https://doi.org/10.1016/j.chb.2014.07.037

Robbins, T., & Clark, L. (2015). Behavioral addictions. *Current Opinion in Neurobiology*, *30*, 66–72. https://doi.org/10.1016/j.conb.2014.09.005

Robey, D., Anderson, C., & Raymond, B. (2013). Information technology, materiality, and organizational change: A professional odyssey. *Journal of the Association for Information Systems*, *14*(7), 379–398. https://doi.org/10.17705/1jais.00337

Robinson, T. E., & Berridge, K. C. (2003). Addiction. *Annual Review of Psychology*, *54*, 25–53. https://doi.org/10.1146/annurev.psych.54.101601.145237

Rollings, A., & Adams, E. (2006). *Fundamentals of game design*. Upper Saddle River, NJ: Prentice Hall.

Sanders, B., Dowland, P., & Furnell, S. (2011). *Implications and risks of MMORPG addiction: Motivations, emotional investment, problematic usage and personal privacy*. Paper presented at the South African Information Security Multi-Conference, Port Elizabeth, South Africa.

Serenko, A., & Turel, O. (2015). Integrating technology addiction and use: An empirical investigation of Facebook users. *AIS Transactions on Replication Research*, *1*(2), 1–18. https://doi.org/10.17705/1atrr.00002

Snodgrass, J. G., Dengah, H. J. F., II, Lacy, M. G., & Fagan, J. (2013). A formal anthropological view of motivation models of problematic MMO play: Achievement, social, and immersion factors in the context of culture. *Transcultural Psychiatry*, *50*(2), 235–262. https://doi.org/10.1177/1363461513487666

Snodgrass, J. G., Lacy, M. G., Dengah, H. J. F., & Fagan, J. (2011a). Cultural consonance and mental wellness in the World of Warcraft: Online games as cognitive technologies of 'absorption-immersion'. *Cognitive Technology*, *16*(1), 11–23.

Snodgrass, J. G., Lacy, M. G., Dengah, H. J. F., & Fagan, J. (2011b). Enhancing one life rather than living two: Playing MMOs with offline friends. *Computers in Human Behavior*, *27*(3), 1211–1222. http://doi.org/10.1016/j.chb.2011.01.001

Soror, A. A., Hammer, B. I., Steelman, Z. R., Davis, F. D., & Limayem, M. M. (2015). Good habits gone bad: Explaining negative consequences associated with the use of mobile phones from a dual-systems perspective. *Information Systems Journal*, *25*(4), 403–427. https://doi.org/10.1111/isj.12065

Steelman, Z. R., Hammer, B. I., & Limayem, M. (2014). Data collection in the digital age: Innovative alternatives to student samples. *Journal of Consumer Psychology*, *23*(2), 212–219. https://doi.org/10.25300/MISQ/2014/38.2.02

Strong, D. M., Johnson, S. A., Tulu, B., Trudel, J., Volkoff, O., Pelletier, L. R., … Garber, L. (2014). A theory of organization-EHR affordance actualization. *Journal of the Association for Information Systems*, *15*(2), 53–85. https://doi.org/10.17705/1jais.00353

Suh, A., Cheung, C. M., Ahuja, M., & Wagner, C. (2017). Gamification in the workplace: The central role of the aesthetic experience. *Journal of Management Information Systems*, *34*(1), 268–305. https://doi.org/10.1080/07421222.2017.1297642

Tabachnick, B. G., & Fidell, I. S. (2001). *Using multivariate statistics*. Boston, MA: Allyn and Bacon.

Tarafdar, M., & Davison, R. M. (2018). Research in information systems: Intra-disciplinary and inter-disciplinary approaches. *Journal of the Association for Information Systems*, *19*(6), 523–551. http://doi.org/10.17705/1jais.00500

Tarafdar, M., Gupta, A., & Turel, O. (2015). Special issue on 'dark side of information technology use': An introduction and a framework for research. *Information Systems Journal*, *25*(3), 161–170. http://doi.org/10.1111/isj.12070

Taylor, J., & Taylor, J. (2009). *A content analysis of interviews with players of massively multiplayer online role-play games (MMORPGs): Motivating factors and the impact on relationships*. Paper presented at the International Conference on Online Communities and Social Computing, San Diego, CA.

Thayer, R. E., Newman, J. R., & McClain, T. M. (1994). Self-regulation of mood: Strategies for changing a bad mood, raising energy, and reducing tension. *Journal of Personality and Social Psychology*, *67*(5), 910–925. https://doi.org/10.1037/0022-3514.67.5.910

Theotokis, A., & Doukidis, G. (2009). *When adoption brings addiction: A use-diffusion model for social information systems*. Paper presented at the International Conference on Information Systems, Phoenix, AZ.

Thomas, J. (2014). Online gamers beware, you might be dangerously addicted. Retrieved from https://www.thenational.ae/opinion/online-gamers-beware-you-might-be-dangerously-addicted-1.257279

Trepte, S., & Reinecke, L. (2011). The pleasures of success: Game-related efficacy experiences as a mediator between player performance and game enjoyment. *Cyberpsychology, Behavior and Social Networking*, *14*(9), 555–557. https://doi.org/10.1089/cyber.2010.0358

Turel, O. (2015). Quitting the use of a habituated hedonic information system: A theoretical model and empirical examination of Facebook users. *European Journal of Information Systems*, *24*(4), 431–446. https://doi.org/10.1057/ejis.2014.19

Turel, O., & Serenko, A. (2012). The benefits and dangers of enjoyment with social networking websites. *European Journal of Information Systems*, *21*(5), 512–528. https://doi.org/10.1057/ejis.2012.1

Turel, O., Serenko, A., & Bontis, N. (2011). Family and work-related consequences of addiction to organizational pervasive technologies. *Information & Management*, *48*, 88–95. https://doi.org/10.1016/j.im.2011.01.004

Turel, O., Serenko, A., & Giles, P. (2011). Integrating technology addiction and use: An empirical investigation of online auction users. *MIS Quarterly*, *35*(4), 1043–1051. https://doi.org/10.2307/41409972

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology toward a unified view. *MIS Quarterly*, *27*(3), 425–478. https://doi.org/10.2307/30036540

Volkoff, O., & Strong, D. M. (2013). Critical realism and affordances: Theorizing IT-associated organizational change processes. *MIS Quarterly*, *37*(3), 819–834. https://doi.org/10.25300/MISQ/2013/37.3.07

Wang, C., Lee, M. K., & Hua, Z. (2015). A theory of social media dependence: Evidence from microblog users. *Decision Support Systems*, *69*, 40–49. https://doi.org/10.1016/j.dss.2014.11.002

Wang, H., & Sun, C. T. (2011). *Game reward systems: Gaming experiences and social meanings*. Paper presented at the DiGRA Conference, Hilversum, the Netherlands.

Wegmann, E., Stodt, B., & Brand, M. (2015). Addictive use of social networking sites can be explained by the interaction of internet use expectancies, internet literacy, and psychopathological symptoms. *Journal of Behavioral Addictions*, *4*(3), 155–162. https://doi.org/10.1556/2006.4.2015.021

Xu, Z., Turel, O., & Yuan, Y. (2012). Online game addiction among adolescents: Motivation and prevention factors. *European Journal of Information Systems*, *21*(3), 321–340. https://doi.org/10.1057/ejis.2011.56

Xue, Y., Dong, Y., Luo, M., Mo, D., Dong, W., Zhang, Z., & Liang, H. (2018). Investigating the impact of mobile SNS addiction on individual's self-rated health. *Internet Research*, *28*(2), 278–292. https://doi.org/10.1108/IntR-05-2017-0198

Yang, S., Liu, Y., & Wei, J. (2016). Social capital on mobile SNS addiction. *Internet Research*, *26*(4), 982–1000. https://doi.org/10.1108/IntR-01-2015-0010

Ye, J. (2015). Gaming addiction leads to risky decisions. Retrieved from https://yaledailynews.com/blog/2015/02/03/gaming-addiction-leads-to-risky-decisions/

Yee, N. (2006a). The demographics, motivations, and derived experiences of users of massively multi-user online graphical environments. *Presence*, *15*(3), 309–329. https://doi.org/10.1162/pres.15.3.309

Yee, N. (2006b). Motivations of play in online games. *Cyberpsychology & Behavior*, *9*, 772–775. https://doi.org/10.1089/cpb.2006.9.772

You, S., Kim, E., & Lee, D. (2017). Virtually real: Exploring avatar identification in game addiction among massively multiplayer online role-playing games (MMORPG) players. *Games and Culture*, *12*(1), 56–71. https://doi.org/10.1177/1555412015581087

Young, K. (2009). Understanding online gaming addiction and treatment issues for adolescents. *American Journal of Family Therapy*, *37*(5), 355–372. https://doi.org/10.1080/01926180902942191

Young, K. S. (2008). Internet sex addiction – Risk factors, stages of development, and treatment. *American Behavioral Scientist*, *52*(1), 21–37. https://doi.org/10.1177/0002764208321339

Zhang, K., Chen, C., Zhao, S., & Lee, M. (2014). *Compulsive smartphone use: The roles of flow, reinforcement motives, and convenience*. Paper presented at the International Conference on Information Systems, Auckland, New Zealand.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Lee ZWY, Cheung CMK, Chan TKH. Understanding massively multiplayer online role-playing game addiction: A hedonic management perspective. *Inf Syst J*. 2020;1–29. https://doi.org/10.1111/isj.12292